MASONRY ANCHORS

BUILDERS OFTEN FIND IT NECESSARY to fasten one thing or another to concrete. Perhaps a curtain wall must be anchored or a conduit strap attached. Whatever the attachment, the builder must decide how to put it in place and how to make sure that it stays put. Fastening is an important part of the job.

Builders have been tacking accessories to concrete for hundreds of years. Some of their methods have been crude. Others have been amazingly inventive. Meanwhile, all through the years, construction men have been looking for stronger and better anchoring devices. They are constantly searching for fasteners that offer extreme holding power along with convenience of installation.

One of the oldest fasteners known to the industry is the pre-set anchor. Pre-set anchors are put in place at the time the concrete is placed. They are designed in advance to fit the accessory to be attached. In the trade pre-set anchors are also sometimes called inserts.

An L-shaped metal rod is the most frequently used pre-set anchor. The rod is threaded at the protruding end. Another familiar anchor is an embedded metal box to which a bolt or rod can be threaded. Pre-set bolt inserts are also frequently used. They can be easily placed at strategic points in the concrete skeleton.

A properly installed pre-set anchor adequately fills its mission. Its holding power is indisputable. Once in place, the anchor simplifies fastening. It is tailor-made for the fixture it supports. But, in spite of its merits, many builders learned long ago that the disadvantages of pre-set anchors often outweigh the advantages.

Pre-set anchors have one serious drawback. They complicate the placement and curing of concrete. Everyone from the architect to the specifications writer must figure them into his work. The work crew must place them carefully in just the right spot. Otherwise, they are useless. The anchors serve no purpose unless they fit the holes of the fixture to be attached.

Many pre-set anchors add to the cost of formwork. They must fit into the forms. Templates are needed for the most exacting pre-set installations—another cost factor. Once installed, the pre-set anchor cannot be moved or adjusted. A mistake in installation costs money. Pre-set anchors must be handled by skilled workmen, adding to labor costs.

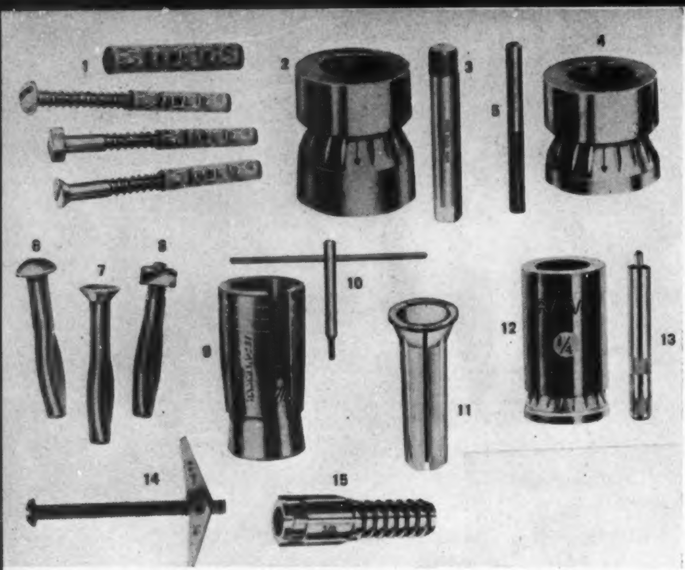
As an alternative, the builder may install his anchors after the concrete hardens. A popular way to do this is first to drill a hole in the hardened concrete, then to insert the anchor. The holes can be made with electric drill and carbon-tipped masonry kit or with hand or electric hammer using steel percussion masonry bit. The anchor itself may be a simple steel nail. In all probability, however, it is a carefully engineered device. It is designed to stay in place and to support heavy attachments.

Many masonry anchoring devices use the expansion principle. An expansion anchor is fitted snugly into the pre-drilled hole. It then expands, firmly gripping the concrete. A patent on the first expansion anchor was granted in the late 1890's. Since then, many types have been designed.

One popular type is the expansion-shield bolt anchor. This device employs a lead or alloy sleeve

This drive pin was pulled by a hydraulic jack from the concrete into which it was driven. Note how the concrete adheres to the pin. The high velocity with which the drivepin entered the concrete and the resulting compaction have literally fused the concrete to the pin.

FILE: Fasteners



The range and variety of devices which have been developed for fastening to masonry is almost unlimited. Pictured here are some of the types offered in just one manufacturer's line: 1. Masonry anchor formed of braided jute for use with wood, sheet metal and lag screws. 2, 3, 4 and 5. Parts of a multiple-unit caulking bolt anchor. 6, 7 and 8. Three types of one-piece expansion bolts (round, countersunk and stud). 9. A machine bolt hammer-set anchor. 10. A pre-expander sometimes used with hammer-set anchors. 11. A flexible screw anchor for use with wood, sheet metal or lag screws. 12. A machine screw anchor with a lead caulking sleeve specially developed for masonry anchors. 13. Caulking tool. 14. A spring wing toggle bolt of the type used for anchoring to hollow masonry. 15. A lag screw shield which has tapered annular rings to prevent withdrawal from the drilled hole.

(shield) in which a bolt is inserted. As the bolt is threaded into place, the sleeve expands. It grips the concrete, providing sufficient holding power to keep the accessory firmly attached. The expansion shield, of course, must fit the pre-drilled hole tightly at the outset. Its installation requires careful work with a hammer or setting tool.

There are several varieties of bolt expansion shields. A lag shield, or lag-bolt expansion shield, opens at the bottom. The shield spreads out into a cone when the lag bolt is tightened. As the shield expands, it bites into the concrete. Its ribbed surface gives the shield a firm grip. A ¾-inch lag shield has a holding power of up to 4,000 pounds.

Another type is the closed-end, bottom-bearing expansion shield. In this type, an expander nut as well as a bolt is inserted inside the shield. The nut moves up and expands the shield when the bolt is tightened. This anchor is desirable for shallow concrete. The shield can be seated although the machine bolt may not fit tightly against the supported attachment. The bearing is at the bottom.

Another machine-bolt anchor is a hammer-set device. This type consists of a tubular expansion sleeve and a conical expander nut. The sleeve, along with the nut, is dropped into the hole, nut down. The anchor slips about half way in and is driven flush with the hole with a hammer.

The fixture to be attached is then put into place. A bolt runs through the fixture into the anchor and fits into the conically shaped nut. As the bolt is tightened, the nut is drawn up into the shield. The shield expands, gripping the concrete from top to bottom.

Manufacturers point to several advantages of the tubular, single-slit anchor. It has a rigid grip, even in holes that are unevenly drilled, and requires a smaller, shallower hole than many other machine-bolt types. This particular anchor is therefore preferable for many special jobs. It has substantial holding power even in hollow materials and interference with reinforcing bars is minimal.

Bolt-expansion shields of various types have many applications. They are used to install pipe hangers, sprinkler systems, and conduit clamps. Such anchors have sufficient holding power for plumbing fixtures and ornamental iron. They are used to bolt signs into place and to hang window frames.

Another versatile fastener is the wood- and lag-screw fiber anchor. The shield consists of heavily braided jute, with a lead liner. The screw drives into the jute shield. As it moves inward, the screw carves its own thread into the lead lining. The lining prevents the screw from cutting the jute.

In relation to the size of the hole, the fiber anchor has an unusually large expansion. The expanded shield grips the walls of the hole firmly. The expansion extends the full length of the anchor, providing maximum holding power. The fiber reaches into any irregularities within the hole. The resulting grip resists shock and vibration.

The fiber anchor fits wood screws ranging in length from 1 inch to 3½ inches and lag screws of from 2½ to 7 inches. The length of the anchor equals the length of the screw threads. The outside diameter of the anchor is not much larger than the screw itself.

One advantage of the fiber anchor is that it can be used without first hole spotting the fixtures. The fixture can be holed at the same time the anchor hole is pre-drilled. If necessary, the screw can easily be removed after it enters the anchor and re-inserted. It merely bores into the original threads for the second time. Thus, fixtures can be removed and re-installed with no sacrifice in holding power—another big advantage.

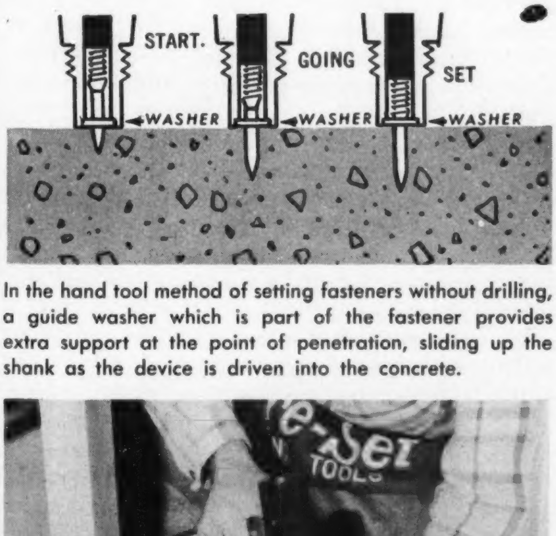
The expanded stud-type drive bolt anchor is a one-piece fastener. Made of alloy steel, it is designed for attaching fixtures that might later be moved. Its stem is partially slit lengthwise. Sides

of the stem bulge out. The pre-expanded sides are compressed when the anchor is hammered into a pre-drilled hole. The compressed sides thus exert a springlike grip, producing a holding power of up to 12,700 pounds.

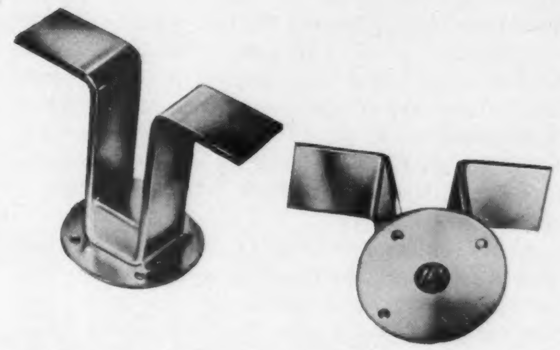
For really heavy jobs, builders customarily use multiple-unit machine-bolt anchors. Such anchors consist of two or three units. Each unit is made up of a lead sleeve and a hard cone. The sleeve fits over the cone. To install the anchor, the workman caulks each unit individually with a caulking tool.

There are two basic types of multiple-unit expansion bolt anchors. In the head-out anchor type the cone is threaded to receive the bolt. In the head-in type the bolt fits head-in into a hollow cone. The bolt head sits squarely in the cone to prevent it from slipping. The protruding end of the bolt is threaded. A nut can be attached. This type is known as a head-in anchor. A three-unit anchor of this type has a holding power of up to 28,000 pounds and meets all the demands of heavy-duty work.

Another type of anchor requiring a pre-drilled hole is the self-drilling expansion shield anchor. Thought by many to be the easiest to install, this type of anchor provides remarkable holding power at nominal cost. It dispenses with the need for conventional masonry drills, since the anchor itself is an expendable hollow masonry drill which makes its own hole.



In the hand tool method of setting fasteners without drilling, a guide washer which is part of the fastener provides extra support at the point of penetration, sliding up the shank as the device is driven into the concrete.



Designed primarily for suspending heavy loads such as piping, cable, and rods from concrete walls and ceilings, this U-shaped insert can also be used in mounting machinery and equipment to plant floors. A heavy-gauge circular nailing plate holds the insert rigidly in place on wood forms and is flush with ceiling, wall, or floor after concrete is placed and forms are removed. The 5/8-inch nut floats in a sealed compartment within the insert to provide full adjustment during installation and also off-angle adjustment up to 10 degrees.

After the hole has been drilled a case-hardened conical steel plug is placed in the cutting end of the drill and the drill is then replaced in the hole and expanded. In this operation the bottom of the hole is actually undercut, a factor which largely accounts for the excellent holding power. Although the self-drilling expansion shield anchor has a wide range of usefulness, it should not be used in very shallow concrete, or in hollow tile or block.

The pre-drilled hole has been used for a long time as a means of inserting concrete anchoring devices and will undoubtedly be used for many years to come. But in recent years construction men have been turning more and more to still another way of installing anchors. They have been shooting pins and studs directly into the concrete by means of an explosive powder-actuated device. Engineers developed this method for repairing ships during World War II and the practice spread from steel to concrete. Although it has some limitations, the method can be applied to a wide variety of fastening jobs.

The tool itself is a pistol-like instrument that is easily loaded and easily handled. The workman inserts the explosive and the fastener into a forward chamber, then closes the handle and trigger assembly. He holds the tool against the concrete, depresses the barrel and pulls the trigger. The tool fires and the fastener is set instantly.

Powder-driven fasteners have wide applications. They are used to fasten light fixtures, conduit straps, pipe hangers, curtain walls, wood sleepers, roof flashings, and many other fixtures. Drive pins, eye pins, and threaded studs for the tool are available in all standard sizes.

The pins and studs penetrate the concrete at

velocities of from 800 to 1,800 feet per second. The compression of the concrete gives the anchors their holding power. The compressive bond between the fastener shank and the concrete has developed withdrawal loads of up to 12,000 pounds. The shank diameter of the fastener and the compressive strength of the concrete determine the ultimate holding power.

As the fastener penetrates, the shear strength of the concrete sometimes gives way to the tremendous compression and the concrete breaks near the surface. Except for the appearance, these conical spalled areas are not a serious matter and do not decrease the holding power of the anchor since the compressive bond area goes much deeper into the concrete than the spalled area. Spalling can be controlled by using a spall-reducer device or by setting the fastener through a steel finishing disc.

Users must guard against setting a powder-driven fastener too near an edge. If fasteners are set too close to the edge, the concrete often cracks and the holding power is reduced. The concrete slab must also be at least 2 inches thick to accommodate a powder-driven fastener. Otherwise, the pin may penetrate completely.

As an alternative to the use of explosive charges hand tools can also be used to set threaded studs, drive pins or wire loop fasteners into concrete without drilling or plugging. Fasteners set in this manner have special guide washers which serve to hold them in the setting tool, as well as to provide extra support at the penetration point and greater head-bearing area to resist the pulling away of thin materials. These washers slide up the shanks of the fasteners as the fasteners are driven into the concrete.

Numerous special guards or pads enable powder actuated tools to be used for an unusually wide variety of fastening applications. Here a lather fastens lathing channel with a tool equipped with a special guard for this purpose. This special guard, which fits two sizes of lathing channel, is completely safe and permits fastenings which aren't possible with the standard guard. Other stock special guards are available for fastening angle iron, corrugated roofing, conduit clamps, narrow door bucks and sheet metal straps, among other things. Custom-designed guards are also available.

One of the newest developments in the field of powder-actuated fastening tools is this fully automatic model which fires eight times on a single loading. The resulting speed-up is said to be significant.

Many years of use and experimentation have proven the worth of concrete anchors. Yet, at most gatherings of engineers and professional builders, there is bound to be some discussion of fastening problems. Somehow, fasteners have not been tested or standardized to the extent that other construction components have.

Fortunately, manufacturers give reliable data in their catalogs as to the application and holding power of concrete anchors. But all too often the builder himself fails to select the right fastener for the job. An anchor designed for a very light accessory can hardly be expected to do heavy-duty work.

The builder, in selecting a fastener, should first know the strength of his concrete. He should also determine the tensile strength of the bolts to be used. Such variables as the shrinkage or expansion of concrete should also be considered. All these factors must be weighed against the size and pull of the fixture.

The concrete anchor will fulfill its task if properly selected and handled. Anchors have been holding things to concrete since cement, sand and gravel were first put together. Without a doubt, the anchor—be it pre-set, pre-drilled, or powder-driven—will be carrying its load for years to come. END

Readers who would like to have additional information on the subject of masonry anchors may request it by circling the appropriate key letter on the reader service card in this issue.

CONCRETE FOR HIGH-RISE BUILDINGS

EVER SINCE THE INDUSTRIAL REVOLUTION the peoples of the world have been gravitating in huge numbers to urban areas. One result has been that land costs in preferred areas have become almost prohibitive and buildings have gone higher and higher in the quest to do as much as possible on as little land as possible.

Concrete has played an increasingly important role in the efforts of architects and engineers to find a satisfactory and economical material for high-rise multistory buildings. The first concrete skyscraper was built in 1902 in Cincinnati, Ohio. It was the 16-story, 210-foot high Ingalls Building which, incidentally, just received a face-lifting and is still in active use.

Today the highest reinforced concrete building in the world is the Banco de Estado, a 507-foot, 34-story building in Sao Paulo, Brazil. In Chicago, right across the street from the Executive House —a 38-story hotel that set a U. S. concrete building height record when it was built about three years ago—there is now under construction a pair of apartment buildings that will be not only the highest apartment buildings but also the highest concrete frames in the world.

The reasons for this surge in the use of concrete for high-rise buildings are manifold. The continuity concrete affords a building frame provides unequalled structural interaction of its parts. Concrete floor systems, such as flat slab and flat plate, offer the smallest possible floor depths. Material costs are low. Concrete is readily adaptable to unusual plans, for example the curved and circular designs now so popular. High strength reinforcing rods are extending concrete's potential in this field. Ultimate strength design, now gaining acceptance in the United States, provides a more efficient means of designing in concrete. And finally concrete building frames are low in cost. Even in the United States, where labor costs are the highest in the world, concrete frames are notably economical.

In a recent test held by the New York City Housing Authority, competitive bids were called for on alternate concrete and steel frames for three 20-story apartment buildings. Every one of the nine contractors who bid on this contract bid concrete lower than steel; and the average concrete bid was more than half a million dollars less than the average bid for the steel frames. In addition, plumbing and electrical bids were lower. These advantages have resulted in increased use of concrete for multi-story buildings.

Modern high-rise concrete buildings are models of design skill in the use of materials. It is now a commonplace to specify high strength concrete, usually 5,000 psi, for compression members in the lower stories of multi-story buildings. Concentration of reinforcing bars in these members is very high. The trend toward buildings other than rectilinear in shape is producing some unusual structural members. All of these factors spell placing problems unless a mix design is formulated that produces concrete of considerable flowability and high quality.

The problem of obtaining uniform, high-quality

FILE: High-Rise Buildings

concrete in this work hinges mainly on two basic considerations: (1) mix design; and (2) placing and curing procedures.

Designing a concrete mix that provides the properties desirable in high-rise buildings using available materials often constitutes a real challenge. In a project as large as a high-rise building, a number of trial mixes should be made to arrive at a concrete which will satisfy the needed requirements. The major problems in this work are: maintaining economy; preventing segregation; minimizing bleeding and formation of laitance; and securing desired flowability, uniformity, durability and high strengths.

Since high-rise buildings often take a year or more to build, the mix design must take into account the radically varying ambient conditions that will be encountered during construction. In addition, more than one basic mix design might very well be needed for a high-rise building. For example, a number of buildings now make use of lightweight aggregate concrete for the floor slabs but regular concrete is specified for columns and sheer walls. Since many lightweight aggregates are angular, achieving thorough particle coating becomes a problem and special steps must be taken to insure good workability and finishing qualities. Even if regular concrete is used for the entire structure, the mix design for foundations most probably would not be the same as that for exposed columns.

In high-rise buildings where reinforcement concentration is often quite heavy, care must be exercised that the maximum coarse aggregate size used does not prevent proper consolidation of the concrete in narrow forms and around the bars. The American Concrete Institute Building Code provides that the maximum size of the aggregate shall not be larger than one-fifth of the narrowest dimension between sides of the forms nor larger than three-fourths of the minimum clear spacing between the bars.

The narrow, high forms often used for columns and shear walls aggravate the tendency of mixes to bleed and produce laitance. These problems are quite common in the tall building construction field, but they can be prevented by close attention to two aspects of the mix design: (1) cement paste consistency and physical composition; and (2) characteristics of the aggregates.

The major points with respect to the latter in preventing bleeding are avoiding harsh or smooth non-absorbent aggregates and poor gradation. Harsh aggregates of poor particle shape usually result in the need for more cement paste and invite addition of extra placing water by workers on the job site. Watering concrete aggravates bleeding and makes segregation more likely, which in turn causes water gain.

Air entrainment and minimum water content can play an important role in halting bleeding, formation of laitance and segregation. As has been mentioned, the height and narrowness of columns and shear wall forms render these problems particularly troublesome. When the unit water content can be lowered by proper proportioning of the mix and the use of an air-entraining water reducing agent, water gain, naturally, will be reduced. In addition, air entrainment results in a fatty, more cohesive concrete that resists segregation better than a non-air entrained mix. Besides lowering water content and bleeding, compounded water reducing and air entraining agents result in higher strengths and better workability —both highly desirable in placing concrete for high-rise buildings.

Without proper placing procedures, however, even the best designed concrete will segregate and bleed, resulting in honeycombing, poor bond to steel and other woes. In general the usual desirable placing procedures apply to concreting tall building members. However special care must be taken with respect to some aspects of placing.

Because column and wall forms are usually rather high and reinforcing bars are often spaced quite closely, workmen must be careful in depositing and vibrating concrete in this work. Concrete should be dropped in a true vertical plane and have a free fall of no more than four feet. For deep forms, concrete should be discharged into a hopper to which is attached a flexible drop chute extending to within four feet of the bottom of the form. If this is not done, the coarse aggregate will ricochet through the network of bars and against the sides of the forms, causing separation. In addition the bars and forms will be coated with mortar which will dry out before concrete is placed over it. The result is mottled surface appearance, dusting and poor bond strength.

Should this placing procedure be impossible because of type or concentration of reinforcement, a duct should be built at each third space between studs. The hopper that feeds these ducts should be built with a pocket below the duct opening so that the concrete flows smoothly into the form. If the concrete is discharged at an angle to the sides of the form, it will bounce off the sides and against the bars, thereby resulting in separation despite the use of the duct system.

In deep, narrow forms consistency of the concrete must be varied. A mix of higher slump (say from 4 to 6 inches) should be used at the bottom of the form with mixes of progressively lower slumps towards the top. Water gain will help equalize the over-all quality of the concrete and settlement shrinkage will be kept to a minimum.

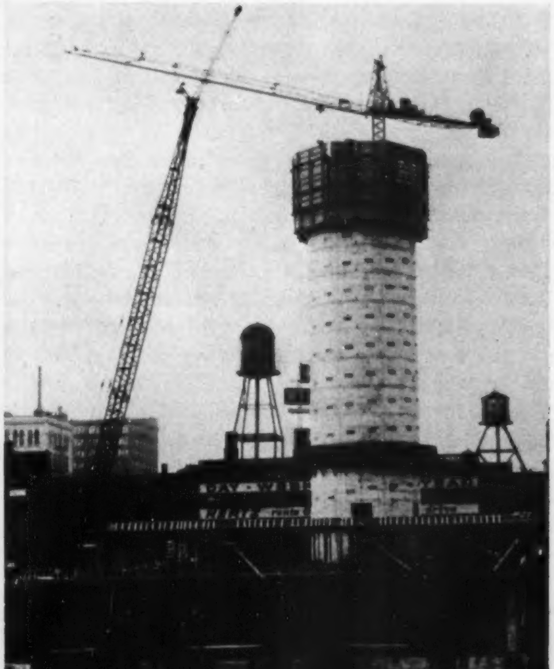
Vibration can be a great help in concreting high-rise buildings because it permits use of lower water contents. However vibration can be misused. If it is employed with wet mixes or continued for

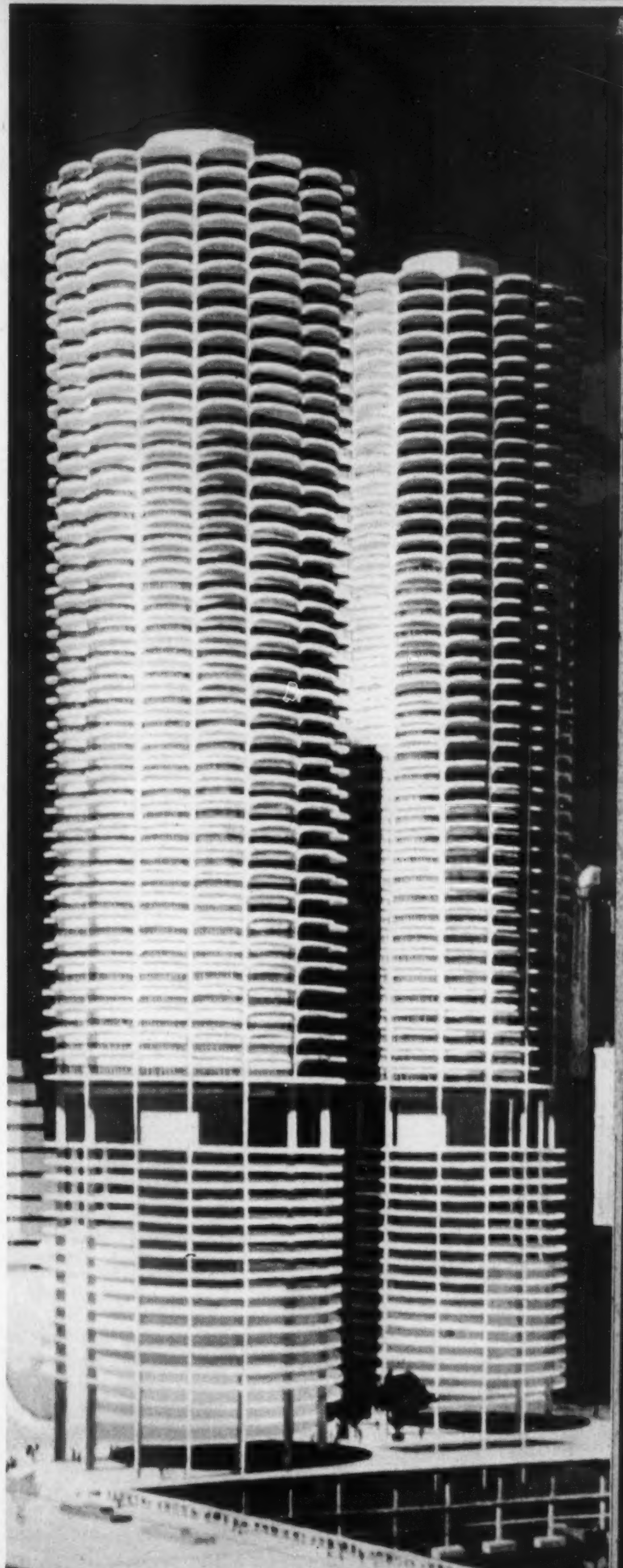
too long, separation will result. Also, if vibration is used to move concrete horizontally, rather than to compact it, the surface will be torn and poorly consolidated.

In vibrating lifts, especially those containing concretes of different slumps, uniform angle of penetration of the vibrator head should be maintained. Also make sure that the vibrator head penetrates a few inches into the previous layer of concrete to effect thorough consolidation of the two lifts. If some time must elapse between casting of successive lifts, a retarder should be used to insure plasticity of the previous lift when the next layer is to be cast.

Placing and finishing practices also have an

Shown below in an early stage of construction and at the right as they will look when completed, the 60-story group of buildings in Chicago to be known as Marina City typify the new freedom which modern concrete construction has brought to the design of high-rise structures. A self-lifting crane which can revolve 360 degrees is being used to hoist forms, reinforcement and concrete. When completed the 588-foot towers will be the tallest reinforced concrete buildings in the world.





The reinforced concrete frame of the Denver-Hilton Hotel, another example of an all concrete high-rise structure, was faced with more than 450,000 square feet of concrete curtain wall.

important bearing on the quality of concrete flatwork. Concrete should be dumped into the face of the concrete already cast—not away from it. If concrete is to be placed on a slope, always start at the low point and work toward the high point—never the reverse. If a chute is used to place concrete on a slope, a baffle should be positioned at the end of the chute to break the velocity of the concrete flow.

These desirable proportioning and placing practices will also largely hold true for lightweight concrete, now so popular for floor and roof slabs in tall buildings. However there are some differences due to the unit weight and absorption characteristics of lightweight aggregates.

Lightweight aggregates are broadly divided into two classes: extra-light (such as vermiculites and expanded perlites); and medium-light (for example, expanded clays and shales). Only the latter are capable of developing the high compressive strengths for the structural members of high-rise buildings.

These medium-lightweight, high-strength aggregates may be further divided into two types: coated aggregates—those generally rounded in shape and with a hard, relatively impervious coating over a porous core; and crushed aggregates—usually angular, irregular-shaped particles produced by grinding to size large lumps of material exploded, so to speak, from the parent material. As might be expected, coated aggregates are preferable because they absorb less moisture and produce a more workable concrete.

Uniform workability of the mix is more difficult to maintain with lightweight aggregates due to their general high absorption and the wide variation in rate of absorption from particle to particle. Because the coarse aggregates are lighter than the concrete mass, they tend to float to the surface when improperly placed.

Air entraining and water reducing agents are of special value in lightweight concrete because they improve workability markedly and reduce water requirements. Higher air contents—up to about 7 percent—should be used than are normally specified for regular concrete.

In measuring air content of lightweight concrete it is important that the volumetric method be used. It is virtually impossible to obtain the specific gravity of lightweight aggregates to the degree of accuracy required by the gravimetric test, and the pressure method is unsuitable for highly porous aggregates.

Slump is not a wholly reliable gauge of workability in normal weight concretes and in lightweight work its dependability is further reduced. If the slump test is used to help measure workability, it should be remembered that the slump for a given degree of workability will be less with lightweight aggregate concrete than with a normal sand-and-gravel mix. Roughly speaking, lightweight concrete with three to seven percent entrained air of two- or three-inch slump will have approximately the same placing characteristics as normal weight concrete of four- or five-inch slump. A more reliable gauge of workability in lightweight concrete work is obtained by use of the V-B Consistometer. A workable lightweight plastic mix would give a reading of from two to five V. B. degrees.

Lightweight mixes should be handled as little as possible. Lightweight mixes tend to entrap air and honeycomb more than normal weight concretes. Although vibration is quite helpful in preventing these defects, careful supervision is needed to prevent over-vibration which would aggravate water gain and segregation. It is easier to notice segregation in working with lightweight concrete because the coarse aggregates, being lighter rather than heavier than the mass, float to the surface when segregation takes place. END

POST IN CONSPICUOUS PLACE

STEEL SCAFFOLDING SAFETY RULES

as recommended by the STEEL SCAFFOLDING AND SHORING INSTITUTE

Following are some common sense rules designed to promote safety in the use of steel scaffolding. These rules are illustrative and suggestive only, and are intended to deal only with some of the many practices and conditions encountered in the use of scaffolding. The rules do not purport to be all-inclusive or to supplant or replace other additional safety and precautionary measures to cover usual or unusual conditions.

SEE SEPARATE SHORING SAFETY RULES

BASIC RULES—ALL SCAFFOLDING

1. **Follow local codes, ordinances** and regulations pertaining to scaffolding.
2. **Inspect all equipment before using.** Never use any equipment that is damaged or deteriorated in any way.
3. **Keep all equipment in good repair.** Avoid using rusted equipment—the strength of rusted equipment is not known.
4. **Inspect erected scaffolds regularly** to be sure that they are maintained in safe condition.
5. **Provide adequate sills** for scaffold posts and use base plates.
6. **Use adjusting screws** instead of blocking to adjust to uneven grade conditions.
7. **Plumb and level all scaffolds** as the erection proceeds. Do not force braces to fit—level the scaffold until proper fit can be made easily.
8. **Fasten all braces securely.**
9. **Do not climb cross braces.**
10. **On wall scaffolds place and maintain anchors** securely between structure and scaffold at least every 30 feet of length and 25 feet of height.
11. **Free standing scaffold towers must be restrained from tipping** by guying or other means.
12. **Equip all planked or staged areas** with proper guard rails, and add toeboards when required.
13. **Power lines near scaffolds are dangerous.** Use caution and consult the power service company for advice.
14. **Do not use ladders** or makeshift devices on top of scaffolds to increase the height.
15. **Do not overload scaffolds.**
16. **Planking:**
    a. Use only lumber that is properly inspected and graded as scaffold plank.
    b. Planking shall have at least 12 inches of overlap and extend 6 inches beyond center of support, or be cleated at both ends to prevent sliding off supports.
    c. Do not allow unsupported ends of plank to extend an unsafe distance beyond supports.
    d. Secure plank to scaffold when necessary.

ROLLING SCAFFOLDS

(Apply additional rules below)

1. **Do not ride rolling scaffolds.**
2. **Remove all material** and equipment from platform before moving scaffold.
3. **Caster brakes must be applied** at all times when scaffolds are not being moved.
4. **Do not attempt to move a rolling scaffold without sufficient help.** Watch out for holes in floor and overhead obstructions.
5. **Do not extend adjusting screws on rolling scaffolds more than 12 inches.**
6. **Use horizontal diagonal bracing** near the bottom, top and at intermediate levels of 30 feet.
7. **Do not use brackets on rolling scaffolds** without consideration of overturning effect.
8. **The working platform height of a rolling scaffold** must not exceed four times the smallest base dimension unless guyed or otherwise stabilized.

PUTLOGS AND TRUSSES

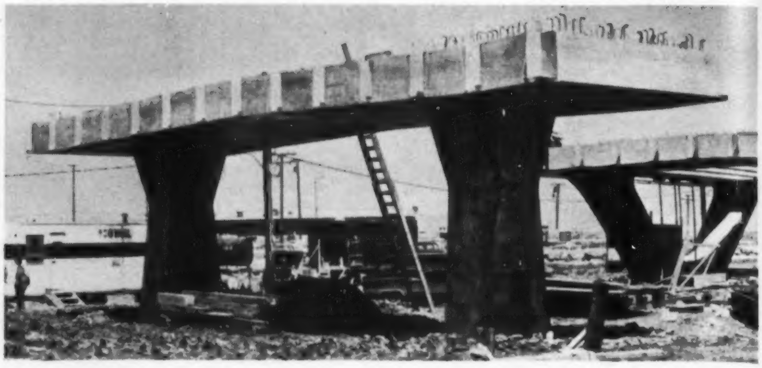
(Apply additional rules below)

1. **Do not cantilever or extend putlogs/trusses** as side brackets without thorough consideration of loads to be applied.
2. **Putlogs/trusses should extend at least 6 inches beyond point of support.**
3. **Place proper bracing between putlogs/trusses** when the span of putlog/truss is more than 12 feet.

NEVER TAKE CHANCES

Consult Your Scaffolding Supplier When in Doubt – Scaffolding is His Business

FILE: Safety



double hour glass

WISHBONE AND HOUR GLASS PIERS

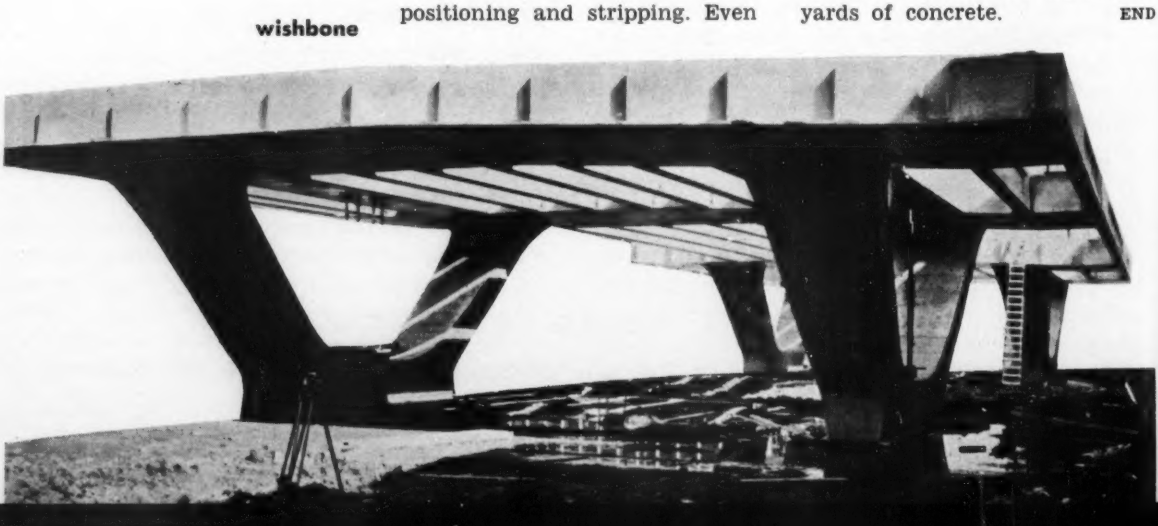
single hour glass

THE THREE reinforced concrete piers pictured on this page represent the interesting, functional and altogether pleasing solution worked out by a Chicago architectural firm to the problems of coping with poor bearing soil and supporting an elevated 60-foot wide vehicular roadway directly above an equally wide ground-level road. When completed the 4,000-foot long structure will provide two-level access to and from a pair of ultramodern airline terminal structures at Chicago's O'Hare Field.

The three types of piers are appropriately described by the designers as wishbones, single hour glasses and double hour glasses. The piers were all formed with specially designed prefabricated steel panels which provided an easy means of both positioning and stripping. Even for the quite complicated wishbone pier, with its two tie-beam units, it was possible to strip, move and reset forms in only three 10-hour days. An important factor in speeding the work was that the forming units were built in large components which made it possible to form the wishbone piers with only 12 major parts, while the simpler double and single hour glass piers required only four and two parts respectively.

Prestressed concrete beams were bracketed right into the pier slabs to permit maintenance of maximum height for lower level traffic and retain minimum height for matching the elevated ramp with exits and entrances in the terminal buildings. In all the U-shaped roadway required 32 piers containing 7,000 cubic yards of concrete. END

wishbone



FILE: Forming

SHRINKAGE

some questions and answers

SHRINKAGE IS INHERENT to the concrete hardening process. If shrinkage is sufficiently restrained, cracking can result. Just how serious is shrinkage, what causes it, and how can we foresee its results? In this article we wili try to deal with the phenomenon of shrinkage and see just what it means to the man in the field.

WHAT IS SHRINKAGE?

To give a straight simple definition of shrinkage would be to say that it is a reduction of volume caused by loss of water. This loss occurs both physically and chemically. Loss of water due to obvious physical agencies can easily be visualized. Sedimentation (bleeding) is one such agency; absorption by forms or porous aggregate another. Vacuum treatment is an example of an applied process. All of these agencies have one characteristic in common: they cause loss of water without affecting the homogeneous nature of the concrete. In other words, before hardening begins any shrinkage due to these factors occurs from a reduction of the water/cement ratio. Since the advantages and need for such a reduction are obvious, and the structure of the mass is not affected, shrinkage up to this stage is not normally objectionable.

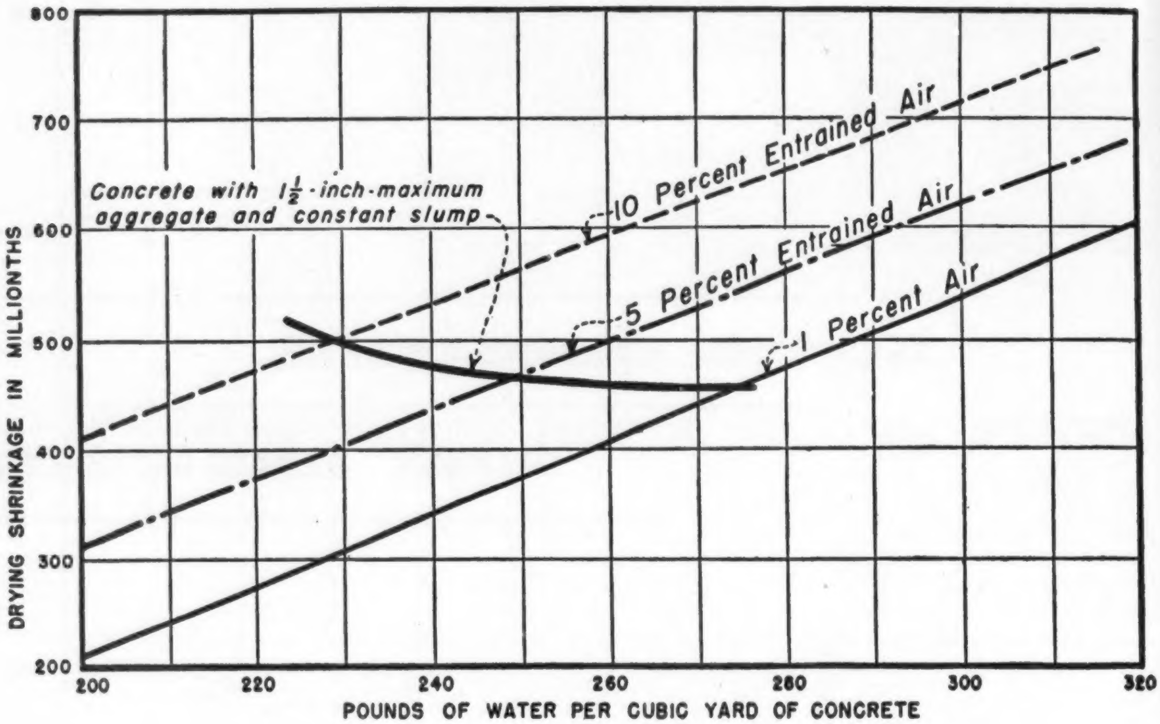
It is after the process of hardening first begins that one single physical agency, evaporation, becomes important; the shrinkage forces then act relative to the two main components of the mass (the cement paste and the aggregates) and the interaction between these forces can lead to cracking. Evaporation is also the main cause of the plastic shrinkage cracks which result from uneven or accelerated loss of water; its effect is influenced to a large extent by such climatic conditions as intensity of air movement and temperature and humidity changes.

Loss of water by the chemical reaction of the hardening process is a little more complex. During hydration the water present in the mix becomes a component of the solid products of the process without any loss of weight occurring. However, the reaction is accompanied by a change in volume; the water loses about 25 percent of its volume in combining with the compounds present in the cement. In wet mixes chemical shrinkage is generally far less important than physical shrinkage, whereas in dry mixes chemical shrinkage becomes increasingly important, even to the point where it may be necessary not only to prevent evaporation of water but also actually to replace the water used up chemically.

(MORE)

FILE: Crack Control

Drying Shrinkage of Hardened Concrete in Relation to Water Content of Fresh Concrete, for Various Air Contents



HOW DOES SHRINKAGE OCCUR?

This is difficult to explain. Laboratory studies have been underway for many years with the object of determining the precise mechanism of shrinkage. Although the subject has been approached from many angles, it is still a controversial topic.

There is an almost limitless combination of influencing factors. From a microscopic examination it can be seen that a fully hydrated cement paste consists of a mass (in texture somewhat like a felt mat) of crystalline centers surrounded by a porous gelatinous material known as the cement gel. The crystalline centers are generally inert and consist of unhydrated remainders plus hydration products; the porous gel is the medium which is susceptible to volume changes upon wetting and drying. The amount of water originally present in the paste when it was mixed decides the proportion of gel and its degree of porosity. The shrinkage in length of a pure gel of portland cement due to drying in air is well over 1 percent under average conditions. If the water/cement ratio is very high, giving a coarse texture, such a gel may have a drying shrinkage of several percent.

This situation changes completely, however, as soon as aggregate is introduced into the cement paste. The aggregate particles then reinforce the structure of the paste and the shrinkage of the concrete is but a fraction (between 1/5 and 1/15th) of that of the neat cement. The relative compressibility of the aggregate and the elasticity of the paste are thus important. This can readily be seen from the following comparison in which a single sieve size of aggregate (passing 3/8 inch, retained on No. 4) was added to the cement paste as a 1:2.5 mix water/cement ratio 0.40:

2-YEAR SHRINKAGE
In Millionths of Length of Unit

Cement paste alone	*2705*
Paste + mixed gravel	*725*
Paste + crushed limestone	*417*

CONCRETE SHRINKAGE—HOW MUCH AND HOW LONG?

The amount of shrinkage can be affected to a major or minor degree by a great many factors: type of cement, type of aggregate, mix proportions, methods of placing and curing, temperature and humidity. Free shrinkage, that is when there is a change in size but not in shape, ranges between 400 and 800 millionths of the length of the unit, for normal cements, aggregates and concreting techniques. Values of 500, 600 and 700 millionths are commonly accepted as indicating low, medium and high shrinkage respectively.

Between 20 and 30 percent of the shrinkage occurs in the first few days, in the period of initial and final set and hardening. About 80 percent of the total is due to evaporation. Long-term studies

have shown that about 75 percent of the total shrinkage in a reinforced concrete structure occurs in the first four years, and 90 percent between 6 and 8 years. Findings were inconclusive as to whether shrinkage had ceased completely even after 16 years.

CAN CHOICE OF MATERIALS AFFECT SHRINKAGE?

CEMENT. The chemical composition of modern cements has no great influence on shrinkage, although some investigators have found a lesser tendency to shrinkage with high lime and low alumina cements. An increase in gypsum content has also been shown to give a slight reduction in shrinkage. These findings are logical enough since the materials give coarse crystalline products of hydration with correspondingly less gel. The evidence with regard to the fineness of the cement used is much clearer. There is no doubt that the tendency to shrinkage increases with increasing fineness of cement. The extent of this tendency is difficult to estimate since it is to a large extent masked by the degree of hydration. Thus the most obvious examples of high fineness giving excessive shrinkage occur when the mix is allowed to dry out at a very early stage of the hydration process.

In general, an increase in cement content increases shrinkage but the effect varies considerably with the type of aggregate used. The overall effect is therefore relatively small. Field studies have shown that for a constant water content per cubic yard, shrinkage remains almost the same for a wide range of cement contents.

AGGREGATE. As stated earlier the aggregate opposes the shrinkage movement in the surrounding cement paste. The less the aggregate particles are able to yield under the compressive forces, the more effective this opposition will be. With a fully-compressible aggregate, for example air in cellular concrete, there is no resistance to shrinkage and the concrete shrinks the same amount as does the cement paste. This has also been confirmed by experiments using fragments of rubber as aggregate.

It is thus obvious that the type of aggregate used will considerably affect shrinkage. The effect of type of aggregate alone on shrinkage is shown by the following figures for 3/16- to 3/8-inch material in a 1:2.5 mix, 0.40 water/cement ratio:

1-YEAR SHRINKAGE
In Millionths of Length of Unit

Slate pebbles	*680*
Mixed gravel	*560*
Granite	*470*
Quartz	*320*
Solid glass spheres	*250*
Crushed limestone	*410*
Sandstone	*1160*

Detailed studies by various authorities have determined the effects of different aggregates on shrinkage for mixes of varying water/cement ratios. Among the pure mineral aggregates, pyroxene and hornblende are alone in producing high shrinkage of concrete. Quartz, feldspar, limestone and dolomite on the other hand are outstanding in giving low shrinkage. Granite, which is a combination of various minerals, logically falls intermediate between the two groups. Granites of higher rigidity can be expected to show lower shrinkage, and vice versa; this also applies to limestones and dolomites, although not to the same degree. Marble chips give high shrinkage.

Aggregates of mixed composition obviously present a problem; those producing concrete of high shrinkage often contain a large amount of sandstone, slate, or other particles which either shrink of themselves or have low rigidity. Conversely, low shrinkage materials usually contain a high proportion of quartz, limestone or feldspar. Sandstone and slate cause high shrinkage not only because of their compressibility but also because they contract appreciably upon drying. An example of this can be quoted from a study with a typical mixed gravel; it was found that shrinkage due to drying from the saturated state was 200 millionths for the slate particles present alone.

The effect of grading has also been studied intensively. In laboratory studies it has been shown that in general, within the range of acceptable gradings for concrete, size of aggregate has little influence on shrinkage. This work has been based, however, on conditions of fixed water content; in practice a large reduction in shrinkage can be obtained with larger maximum sizes of aggregate because of the lower water contents that can then be used. Within normal limits the amount of fines and also particle shape seem to have little effect on shrinkage, again except as they influence water requirements.

WATER. Obviously, from the definition of shrinkage, water content is the greatest single factor affecting shrinkage. Any condition that will permit the use of less mixing water will substantially reduce inherent shrinkage. For each 1 percent increase in the quantity of mixing water used for a concrete, the shrinkage is increased by about 2 percent. This double effect has been revealed from the results of a great many tests with mixes of varying water content. Apparently the 1 percent gives a 1 percent increase in the volume of cement gel present, while at the same time the shrinkage tendency of the gel is increased by about 1 percent because of the presence of the extra water.

STEEL. Any steel reinforcement restricts, but does not prevent, shrinkage in the effective direction of the reinforcement. Free shrinkage of the

concrete immediately adjacent to the steel, that is of the concrete which is directly bonded to the steel, is actually prevented. This means that the concrete in that area is in tension and the steel in compression, the degree of compression being dependent on the amount of concrete involved in the bonding. As far as shrinkage goes, the presence of such a compressive force can thus be seen to be an unnatural state for the concrete as a whole. If reinforcement in the section is then eccentric, the result can be more shrinkage on one side than on the other which leads to the well-known and often destructive occurrence of warping. For this reason it is often preferable to use a large number of small bars rather than a smaller number of large bars, even if the placement of the reinforcing may become more complicated. This warping aspect of shrinkage is obviously more serious for thin slabs and shallow beams.

ADMIXTURES. It has been reasoned that since the function of the aggregate particles is to reinforce the cement paste, shrinkage might be decreased by making the paste more elastic. It was figured that this could be done by introducing an admixture which would lower the tensile strength of the mortar and thus avoid internal cracking between aggregate particles. Various dispersing and wetting agents have been tested with this in mind. In general little effect on shrinkage was noted. Wetting agents appreciably increase the proportion of air voids and permit a substantial decrease in water/cement ratio; however the net effect on ultimate shrinkage is negligible.

CARBON DIOXIDE TREATMENT?

It is fairly well known that concrete absorbs carbon dioxide from the air during the hardening process. Many studies have been made to determine the effect of storing concrete specimens in an atmosphere of carbon dioxide


Better
concrete
through
chemical
research

and also under carbon dioxide pressure. An immediate effect is a considerable increase in strength, comparable to the increase obtained by autoclaving. A marked decrease in irreversible shrinkage has also been obtained. Specimens stored for 28 days in an atmosphere of carbon dioxide showed shrinkage only about one quarter of that of comparable specimens stored in air at 70 degrees and 65 percent relative humidity. It is, however, important to note that these results apply to specimens exposed to carbon dioxide immediately after stripping. When the specimens are allowed to dry out, there is no reduction in shrinkage, but frequently a sharp increase. Apparently the carbon dioxide treatment directly interferes with the chemical reactions of the hydration process. The free lime hydrate of the cement paste, and also the lime present in combination with silica, alumina and iron oxide, is converted into stable calcium carbonates.

This effect is already utilized by many concrete block manufacturers, primarily to obtain an increase in strength. It is comparatively easy to introduce accelerated carbonation into the curing cycle. There seems no reason why such a treatment could not also be used with other factory precast concrete products, but it is difficult to visualize how a practical method could be developed for use with site-cast concrete.

WHAT SHRINKAGE MEANS IN PRACTICE

Clearly shrinkage in concrete is something we have to accept. In practice it means that all designs must allow for shrinkage. If concrete is restrained sufficiently against movement, something must give when it shrinks. Since creep* also enters into the problem, the hypothesis is not

*See "Some Facts, Theories and Guesses Concerning Creep," Concrete Construction, February 1960, page 36.

ALPHA

BETTER CONSTRUCTION THROUGH BETTER USE OF CEMENTS

news and notes from the field

Some Basic Facts About High-Early Strength Concrete

What It Is

The simplest explanation of what is generally called "high-early strength" in concrete is a comparison of the strength of concrete made with Hi-Early (Type III) cement to that of concrete made with Regular (Type I) cement. Approximate relative strengths are shown in the table below. One point that should be kept in mind in such a comparison is that *compressive strength is not always the best measurement of concrete quality*. For instance, the highest strength concrete is not always the most durable. Many other factors also have to be considered although strength is the most commonly used yardstick for job-site quality control.

Relative Strengths of Concrete Made From Hi-Early (Type III) and Regular (Type I) Cements

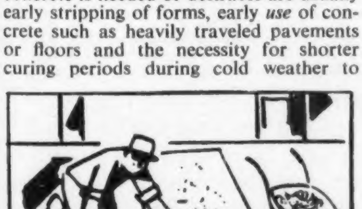
	Compressive Strength 3 Days	28 Days
Regular Cement (Type I)	100%	100%
Hi-Early Strength Cement (Type III)	190%	130%

(Above comparisons do not apply when steam curing is employed)
Tabulation courtesy of "Guide to Better Field Practice", Concrete Construction.

In this tabulation the strength of concrete made with Regular (Type I) cement was used as 100%. It can easily be seen how concrete made with Hi-Early cement gains strength rapidly in the early stages, and how this advantage wanes in the later stages.

When to Use High-Early Strength Concrete

This decision is usually made on the basis of economics. High-early strength concrete is generally used where high strengths at early ages are necessary. Since the production of high-early strength concrete is more expensive, its convenience must offset the additional cost. The factors that determine whether high-early strength concrete is needed or desirable are usually early stripping of forms, early *use* of concrete such as heavily traveled pavements or floors and the necessity for shorter curing periods during cold weather to develop strength to resist freezing at early ages. High-early strength concrete can be produced by using Hi-Early cement or by increasing the cement factor if regular cement is used—more about this later.



For emergency jobs to provide fewer interruptions during remodeling or repairs, high-early strength concrete is often specified.

Earlier form removal is one advantage of using high-early strength concrete.

Why Hi-Early Cement Costs More

Two of the most expensive operations in the production of cement are the burning and preparation of clinker and the grinding of the clinker into finished cement. Both of these operations are more expensive in the production of Hi-Early cement plus additional costs in changing raw material proportions and raw material preparation. These factors account for the increased production costs of Hi-Early cement and its higher price.

When low temperatures are expected at early ages, high-early strength concrete shortens the period of curing and possible freezing damage.

Is Hi-Early Cement Necessary to Get High-Early Strength Concrete?

When a limited amount of high-early strength concrete is needed, it may prove expensive for a concrete producer to stock Hi-Early (Type III) cement for the job. In such a case, he might consider using larger quantities of Regular (Type I) cement to obtain the necessary early strength.

In this event, advance tests of the materials to be used in the job should be made to determine how much cement per yard will be required. To give approximations of what to expect, Alpha's research men did some preliminary testing for comparison. (Several brands of cement were used.) These are the "rules of thumb" resulting from the tests:

1. In general, the strength of relatively *lean* 5 sacks per yard Type III cement concrete can be duplicated at *1 and 3* days by using Type I cement if the cement factor is increased 2 sacks per yard to a 7-sack mix.

2. The strength of *richer*—6 sacks or more—Type III cement mixes can be duplicated at *1 and 3* days with Type I cement by increasing the cement factor by about 2½ sacks per yard to an 8½-sack mix.

3. At 7 days, the strength advantage of Type III concrete becomes less than at earlier ages. To maintain equal strengths of the concrete at 7 days, the cement factor for Type I cement would have to be increased by about 1½ sacks per yard over that of Type III cement.

It can thus be seen that it is easier to duplicate Hi-Early cement concrete strength at 7 days than at the earlier 1 and 3 days.

When Hi-Early cement is used for concrete products (block, precast beams, etc.) there are many other variables to be considered such as aggregates, steam curing and others. Alpha Field Engineers are equipped and ready to help users of our cements achieve maximum efficiency from any application of portland cements.

ALPHA
PORTLAND CEMENT COMPANY
Alpha Building, Easton, Pa.

quite as easy as it sounds. We can isolate shrinkage and say that it must be allowed for, but just how much of a tendency a particular mix has to crack is more difficult to establish. As mentioned earlier, the number of combinations of variables is almost limitless. Much research work still remains to be done; whether it will eventually result in a practical formula for shrinkage control is still unpredictable.

HOW CAN WE LIMIT SHRINKAGE?

There are a few things we can do to avoid the effects of excessive shrinkage. Good design is obviously essential. Proper joint spacing to allow contraction and avoid random cracking, an allowance for stress reduction when calculating prestressing forces, regular spacing of reinforcing bars and avoidance of eccentricity to prevent warping, are all important. In the field three factors having a major influence on shrinkage are within the direct control of the contractor: choice of aggregate, control of water content, and proper curing. The aggregates used should be as rigid and dense as possible. The proportion of coarse material should be as high as possible. The aggregates should also be clean and free from compressible materials which themselves shrink appreciably on drying out. Just what this means in practice can be seen from work by the California Division of Highways; it was found that drying shrinkage in concrete pavements could be reduced by between one-third and one-half simply by washing clay from borderline aggregates.

Avoidance of the use of excess water is always good practice; if lowering the water/cement ratio means a reduction in workability, this can always be offset by the use of air-entraining agents, since these have a negligible effect on ultimate shrinkage.

The last factor (proper curing) is probably the most important.

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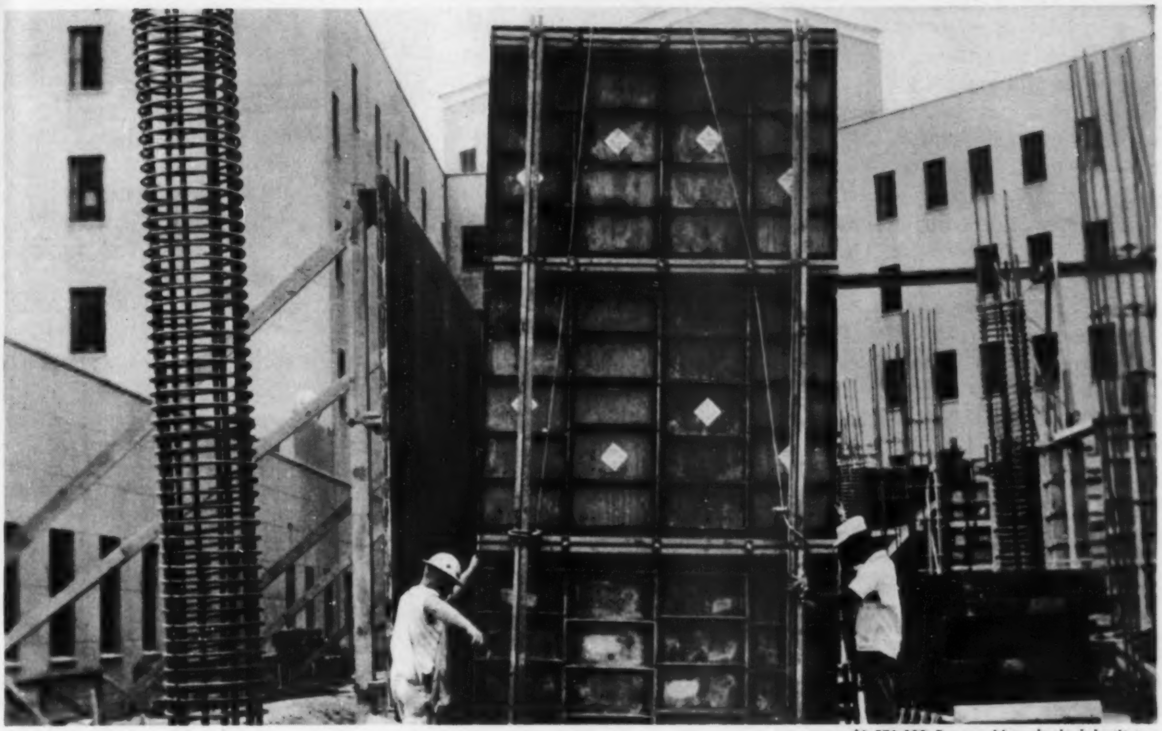


$1,570,000 Barrow Neurological Institute, addition to St. Joseph's Hospital, Phoenix

Gang forming Symons steel-ply forms helps reduce forming costs 20%

Phoenix builders are taking another look at what they believed would be the most complex, cluttered concrete job in the history of Arizona's capital city. Barrow Neurological Institute, a combination five and seven story addition to St. Joseph's Hospital, isn't cluttered. It's clean.

Reason for 20% Cost Reduction

Chief reason for the good showing was the combination forming method used by Gilbert and Dolan, general contractor. The method included the use of (1) regular Symons steel-ply forms on small angular work, (2) the same forms, ganged in 30 x 18 ft sections, for walls, and (3) a steel joist system for the decks. This combination reduced forming costs by about 20 per cent over job-built forms.

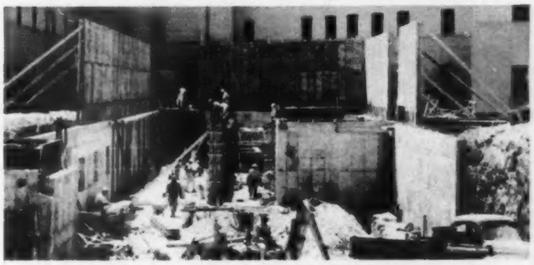
Why Symons Steel-Ply Forms

General superintendent, Henry McNeil and his management chose Symons steel-ply forms to answer most of their problems because:

- Precision built, they could be erected in a hurry, stripped just as easily.
- In case a large wall area was formed and men needed access for steel or utilities setting, a panel could be removed from the gang section at any chosen spot, and replaced in a matter of minutes. The same scheme could be used on high walls or column pours to reduce the height of a concrete drop.
- Forms are available on a purchase or rental basis. In the case of the latter, forms no longer needed could be returned promptly.

Border Products Gets Order

Approximately 12,000 square feet of forms were ordered from Border Products Corporation of Phoenix, Symons representative for the state. In addition, fillers, corners and special angle corners were furnished.



Foundation area for the hospital; shows one side of 30 ft. long gang forms in place.

For more detailed information about Symons steel-ply forms, write:

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MORE **SAVINGS** FROM **SYMONS**

It is known that under normal concreting conditions evaporation is the largest single agency which influences shrinkage. Most authorities attribute up to 80 percent of ultimate shrinkage to this cause. The most drastic result of over-evaporation from a concrete surface is the so-called plastic cracking which occasionally damages even the best-planned job. Such cracking occurs when the rate of evaporation exceeds the rate at which water bleeds from the mix or naturally rises to the surface. Theoretically the tendency of concrete to crack can be lessened or even avoided by causing the strength of the concrete to increase more rapidly than the shrinkage stress. In other words, the natural strength of the concrete should always be sufficiently high to restrain the shrinkage forces.

The curing techniques which control evaporation are generally common practice for any experienced contractor. It is perhaps just as well to review them in the light of shrinkage control:

Be sure to dampen the subgrade and forms before placing the concrete.

In cold weather care should be taken not to overheat the concrete; in hot weather lower the concrete temperature.

Hold the period between start of placing and start of curing to the minimum. Begin curing immediately after finishing by applying sand, wet burlap, paper or a membrane compound. If delays are unavoidable, use temporary coverings or a fog spray.

Under constant average conditions these procedures are adequate. Laboratory studies have proved that shrinkage is unaffected by temperatures up to about 200 degrees, provided the relative humidity remains unchanged. (Above this temperature conditions begin to approximate high-pressure steam curing. The structure of the cement gel is coarsened, and shrinkage can be reduced by as much as 50 percent). The critical clause here is "provided the relative humidity remains unchanged." Since under field conditions this is impossible to control, variations in climate can exert considerable influence. This applies particularly to plastic shrinkage. Two additional measures are then necessary to keep a stable curing environment; these are:

Erecting windbreaks, so that the full velocity of the wind cannot be felt over the concrete surface.

Shading the concrete from the direct rays of the sun.

To sum it up, we can't avoid shrinkage. We must allow for it in design. We can limit it by low water content, by using strong, clean aggregates, and by proper curing. END

letters

craftsmen needed

Sir:

If our industry is ever going to secure architectural wall preference for concrete, it must do more than just make good equipment; i.e. forms, ties, rustication joints, etc. We are going to have to train workmen and foremen to become skilled craftsmen in concrete. This is a considerable educational effort and cannot be accomplished readily, easily or cheaply. We will not get paid for our efforts immediately; if we do get paid, it will only be over a long range period.

One of our problems is that exposed cast-in-place concrete in Northern U.S. has been used primarily for foundations, sidewalks, roads, bridges, retaining walls, and sewage and water treatment plants. It is seldom used for schools, hospitals, apartments, hotels, offices, stores and factories. In those rare cases when exposed concrete *is* used on wall surfaces, it is usually rubbed, which considerably increases the cost. Again exposed concrete walls are usually built with custom-made forms and special ties, which also increases the cost.

In Northern U.S. severe climatic changes, particularly the freezing and thawing, expanding and contracting, have made exposed concrete an architectural liability. As a result of high cost and architectural problems, Northern architects and owners alike have chosen masonry and stone for architectural finishes in preference to concrete, and in consequence there has developed over the years a group of highly skilled bricklayers and bricklayer foremen who specialize in high grade masonry and stone finishes. This is unfortunately not true of concrete in this area.

We believe that concrete can be formed into attractive and permanent architectural finishes at an economical cost. To do this we must develop a fund of knowledge on our subject and a list of do's and don'ts regarding the forming and placing of concrete. Mechanization of the forming and placing of concrete has reduced its cost. Now the big need is to make the "concrete skin" attractive . . . permanently.

The writer's company is right now putting these ideas to a practical test in the construction of a plant and office building to house our own operations. We feel that this is an opportunity for our company to demonstrate to architects and builders everywhere the superior performance and economics of exposed concrete construction properly designed and installed.

Our own enthusiasm is increasing as the building takes shape. The plans, the perspective sketches are fine, but nothing, of course, compares with reality. Our dream is taking shape and with it the possibility of a large new market for our products. But so much depends on details.

Perhaps the readers of CONCRETE CONSTRUCTION magazine would be interested in what we are doing, and in particular in how we are attempting to exercise the control of details which we consider to be essential to a successful outcome. We will be pleased to have you visit the construction site while work is in progress and to cooperate in any way that will enable you to prepare a meaningful message for the important audience your magazine reaches.

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President
Symons Clamp & Mfg. Co.
Chicago, Ill.

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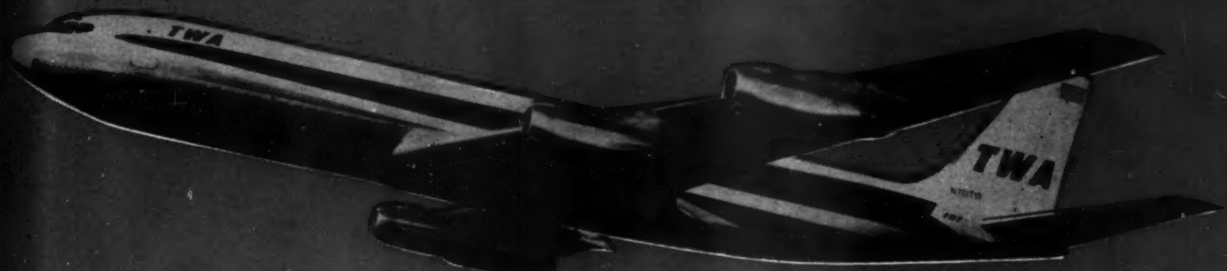

ITINERARY FOR 18 DAY BUSINESS TRIP

Wed. May 16 — **NEW YORK** You will depart New York by overnight jetflight to Lisbon.

Thu. May 17 — **LISBON** Due to arrive in Lisbon in the early morning, where our representatives will meet and transfer you to the *Hotel Embaixador*. In the afternoon you will tour the city visiting some of the more notable construction projects and witness various European handling and construction techniques. For the ladies, there will be a visit to the 18th Century Royal Palace —then to Sintra, Lisbon's largest suburb. The ladies may also make a trip to Pena Castle, then along the mountain road passing Roca Cape to the fishing village of Coscois and the Estoril resort. After dinner a tour of Lisbon by night will be made visiting the colorful cafes.

Fri. May 18 — **IN LISBON** In the morning a visit for the men is scheduled to a products plant and/or a meeting with officials of the Portuguese ministry, regarding the use of concrete products, etc. in Portugal's (Lisbon) new developments.
Afternoon: sightseeing along the Avenida da Liberdade, through Edward VII Park, to Park Belvedere, to the Royal Museum of Coaches and continuing to Jeronimos Monastery and Monsanto Park.

Sat. May 19 — **MADRID** Depart by morning flight to Madrid, where you will be met and transferred to the *Hotel Palace*. Afternoon: Meetings with Spanish officials.

Sun. May 20 — **IN MADRID** Morning sightseeing in the city, viewing the Prado Museum; the Cathedral; Palace of the Spanish Cortes; Puerta del Sol and driving through the main avenues and thoroughfares of this attractive and artistic city.
Afternoon attendance at the Bullfight, Spain's colorful National Sport.

Mon. May 21 — **IN MADRID** For the men there will be an opportunity to see some of the prestressed concrete structures in the area. In the afternoon there will be a visit to Prof. Eduardo Torroja's Institute Technico de la Construccion y del Cemento. Entertainment for the ladies will include a full day's drive to Toledo.

Tues. May 22 — **BARCELONA** Depart by air to Barcelona, where you will be met and transferred to the *Hotel Ritz*. The men will have an opportunity to inspect some of the more notable precast structures in the city and visit at least one products plant.

Wed. May 23 — **IN BARCELONA** Men will visit Barcelona's new housing project, in which concrete products have been used in many ways. Additional uses of concrete products in the city will be shown. For the ladies there will be a drive through the main avenues viewing the Ramblas, Columbus Monument, Town Hall, Gothic Quarter, Ciudadela Park, Cathedral, Gardens of Montijuich Hill, Spanish Village and Font del Gat.

Thu. May 24 — **NICE** Depart by air to Nice, where you will be met and transferred to the *Hotel Ruhl*.

Fri. May 25 — **IN NICE** For the men there will be side trips to some of the precast structures in the area.
After a morning of sightseeing, the ladies may take an afternoon drive over the rugged Grande Corniche with its fine view over the rocky coastline far below and the Blue Mediterranean, arriving in the tiny but world-famous Principality of Monaco. Here you will visit the fashionable resort of Monte Carlo and the fine Casino, returning to Nice by way of the picturesque, fishing ports of Beaulieu and Villefranche.

Sat. May 26 — **ROME** Depart Nice by air to Rome, where you will be met and transferred to the *Hotel Savoy* or *Hotel Caesar Augustus*.

Sun. May 27 thru Sat. June 2 — **IN ROME** During your stay in Rome, you will be attending the Fourth World Conference on prestressed concrete. This is the highlight of our European study tour. The program will be announced later.

NAPLES
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SORRENTO
CAPRI

During your stay in Rome, the following sightseeing will be available at no extra cost:
Full day tour of the city, including the Ancient Roman Forum, the Colosseum, the Fountain of Moses, Basilica of St. Paul, outside-the-Walls, the Statue of Moses by Michelangelo in the Church of St. Peter in Chains; the noble Basilica of St. Peter in the Vatican City, Castel St. Angelo, Trevi Fountain, Borghese Galley and Pincian Hill.
You will also have an opportunity to visit the Olympic Stadium Grounds and see Architect Pier Luigi Nervi's excellent use of concrete products in his designs for the many new buildings.
A two-day excursion to Naples and Capri will also be available during your stay in Rome: Depart Rome early morning of Friday, June 1 and drive via Terracine, Formia to Naples, where you continue to Pompeii, viewing the many private villas, theatres and temples covered by lava during the eruption of Vesuvius in 79 A.D. Thence over the lovely Amalfi Drive to the fishing port of Sorrento. You will remain overnight in Sorrento. The following morning, Saturday, June 2, you will depart by steamer to the romantic and beautiful Isle of Capri, visiting the Blue Grotto (weather permitting) and ascending by funicular to the little town of Capri. Return in the afternoon back to Naples, where rejoin your motorcoach and drive back to Rome, returning in the very late evening to your hotel.

Sun. June 3 — **NEW YORK** You will depart Rome by TWA jetflight returning to New York. However, you may return to New York any way you wish, stopping off at practically any Western European capitol (Paris, London, Amsterdam, etc.) at no extra cost.

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Courtesy of Casa de Portugal

CONDITIONS

TRANSPORTATION: Air transportation, Jet Economy class for Transatlantic flights and Tourist class for European Flights. First class rail; first class local steamers; de luxe motorcoach.

HOTELS: Twin-bedded rooms with private bathrooms in first-class hotels.

MEALS: Continental breakfast and one main meal daily at hotels except in Rome where Continental breakfast only will be provided. Three meals daily on Naples, Sorrento, Capri Tour.

SIGHTSEEING: All excursions and inspection tours by private motorcoach, including guide services and entrance fees.

TRANSFERS: All necessary transfers by motorcoach between airports, piers, hotels and vice versa, including porterage of two pieces of medium-sized luggage per person and the services of our representatives.

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grass versus gravel

Sir:

Perhaps the professional concrete men who read your magazine will be interested in some distaff opinions on the subject of grass versus gravel.

I do not say that concrete driveways, easy-come flowers and bright red gravel will ever equal in beauty a velvety emerald carpet in the front yard. But I like my concrete driveways which, in the absence of a garage, keep our cars off the street. Shrub-vine-perennial flowerbeds furnish bouquets for the house as nearly round-the-calendar as is possible in our climate. And the bright red gravel needs no watering, mowing, clipping, feeding, spraying and weeding.

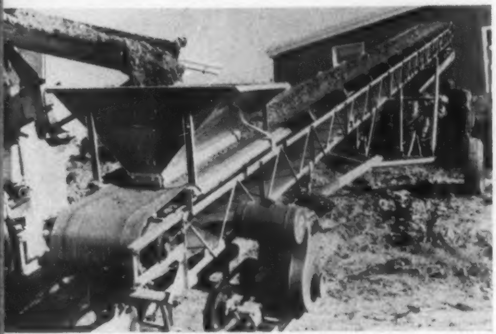
Some husbands, I'm told, are fond of lawns and will spend hours at all these activities. Not mine! His hobby is music and he fiddled while the grass burned—literally. He seldom mowed—never if company was coming. I took over, and many a time I walked barefoot in the fresh-cut grass, huffing and puffing behind the mover. So we got power mowers. The first one was electric, and I kept cutting the cord. My husband thought this wasn't safe, and the next mower was gas-powered. But I could never start it.

I didn't nag—I degrassed! And as it has turned out I'm thrifty. The concrete driveways, flowerbeds and bright red gravel cost about $240. But this is a permanent improvement that has reduced our water bill from $30 a month to $10 a month. (Water comes high in beautiful Colorado Springs, but we love our town and wouldn't dream of moving to California where Colorado's water flows so cheaply). And beside the water, we're saving on the fertilizers and weed-killers.

I'm happy about the whole plan. I should warn you, though, that there are pitfalls. Oh, my husband loves our new and different garden—"the saving on water, the convenience of parking, no mowing staring me in the face after work. But weren't you pretty high-handed to have it done without consulting me? Two hundred and forty bucks right now. . . ."

As I said I didn't nag. But that "without consulting me!" Why, I've talked to him for five years about doing this!

NELL WOMACK EVANS
Colorado Springs, Colo.



portable concrete conveyor

Primary applications of this belt conveyor are to bridge over or under obstructions, and to elevate concrete into forms or hoppers. The machine can place 40 yards of concrete per hour to heights of 22 feet and can handle forms and reinforcing steel as well. This idler roller belt is virtually maintenance-free since all rollers are equipped with sealed-for-life ball bearings which keep the belt running straight in spite of uneven loading. These self-training idler roller conveyors are fully portable in lengths up to 48 feet, discharge up to 33 feet. Morgen Manufacturing Co., Dept. C, Yankton, South Dakota.

catalog of builder's tools

A new 64-page catalog illustrates and describes machines and hand tools used by trowel tradesmen, trowel trades contractors, and general contractors. The book includes descriptions and pictures of a piston pump plastering machine, mechanical drywall texturing equipment and over 1,000 other new and traditional tools. Goldblatt Tool Co., 1910 Walnut, Kansas City, Mo.

horizontal shoring catalog

A 12-page catalog gives the complete story of Rex-Spanall steel shoring. The manufacturer claims this pre-engineered telescopic steel shoring can save time and costs on all poured slab and deck work. Catalog shows construction uses, and gives erection and stripping information. Rex-Spanall, Inc., 6427 W. Capitol Drive, Milwaukee 16, Wis.

catalog on concrete vibrators

An illustrated catalog shows the complete line of Remington vibrators and lists specifications and performance data. The manufacturer claims to have the most complete line of vibrators on the market—gasoline, air and electric powered—and that most parts are interchangeable from model to model. Remington Arms Co., 25000 S. Western, Park Forest, Ill.

handling equipment manual

This manual presents a comprehensive review of basic facts about concrete, its handling, transporting and placing. All types of handling equipment are described and the job each is designed to do is outlined. On-the-job photographs show various types of handling equipment in use. The manual was prepared as a service to the concrete construction industry and is available from Gar-Bro Mfg. Co., 2415 East Washington Blvd., Los Angeles, Calif.

water-proofing agent

A protective, water-proofing agent is readily absorbed into masonry surfaces to protect against subsequent absorption of water and destruction by freezing and thawing. Because of its chemical resistance, Surtiseal is said to protect sidewalks and concrete roads against the destructive action of salt or calcium chloride applied during winter icing, meaning longer life for road surfaces and lower maintenance costs. Guardian Chemical Corp., 38-15 30th St., Long Island City 1, N. Y.

epoxy compounds

Formulated especially for the construction industry, a line of epoxy compounds includes joint sealants, crack sealants, bonding compound, patching compound, skid-resistant surfacing for highways and corrosion resistant surfacing for concrete. The materials are said to exhibit high bond to structural materials, stability over a wide range of temperatures, resistance to corrosion, compatibility to all concrete and masonry, and rapid curing. The manufacturer's sales engineers furnish specific recommendations for use in each application to the contractor at the job site and to the consulting engineer and the public works engineer in their offices. Sika Chemical Corp., 35 Gregory Ave., Passaic, N. J.

vibrator

The homogenizing action of the high frequency, low amplitude vibration produced by a vibrator with a 1¼-inch diameter head results in concrete surfaces virtually free of pock marks, according to the manufacturer. Patching and finishing costs are claimed to be reduced to a minimum. The 120-volt 3-phase 180 cycle induction motor will not slow down and lose vibrating power in low slump concrete. Maginniss Power Tool Co., Mansfield, Ohio.

tool catalog

A 48-page catalog describes a complete lineup of tools for contractors, road builders, tunnel builders, mines, quarries, railroads and factory maintenance. Diagrams detail tool features and there are complete specifications for each model shown. Catalog No. 46, Advertising Dept., Thor Power Tool Co., 175 N. State St., Aurora, Ill.

bracing recommendations

Drawings which cover the most common methods of waling and bracing double and triple lift of forms, single lift of forms for curved walls, waler and strongback assemblies are contained in a single sheet, suitable for hanging in a construction shack or may be folded for insert in notebooks. Symons Clamp & Mfg., 4249 W. Diversey Ave., Chicago, Ill.

residential forms system

The manufacturer claims savings of time and work with a complete system with patented locking hardware bolted to panels and no danger of losing vital parts. Inner and outer forms go up simultaneously with accuracy maintained through positive lever action that "pulls" forms tightly together. For use above or below grade—on residential projects or light commercial construction. Simplex Forms, 5603 Industrial Ave., Rockford, Ill.

construction handbook

A handbook consisting of twelve separate bulletins of between four and twenty-four pages each, describes more than 400 products. Such products for concrete construction as form-tys, anchors, inserts, accessories and supports are described, and forming details and technical data given. The handbook also contains a cross index for products and types of construction. Richmond Screw Anchor Co., Inc., 816-838 Liberty Ave., Brooklyn 8, N. Y.

form coating

An application of two coats of Burke Form Coating is said to deposit on raw plywood forms a hard film which presents a glass-like surface to the poured concrete. Unlike glass or most plastics this film does not shatter or become brittle with age. Panels treated with this formula produce clean concrete surfaces after many pours. Burke Concrete Accessories, Inc., 2690 Harrison St., San Francisco, California.

concrete form catalog

A recently issued catalog has 56 pages of illustrations and descriptions of forms, form ties, accessories, construction specialties and highway products. Universal Form Clamp Co., 1238 N. Kostner Ave., Chicago 51, Illinois.

dampproofing catalog

A new catalog deals with the subject of dampproofing, above and below grade, interior and exterior, for brush, trowel or spray applications of both mastic and semi-mastic types of bituminous coatings for concrete or masonry. A. C. Horn Co., Sun Chemical Corp., 2133 85th St., North Bergen, New Jersey.

steel forms catalog

A 20-page catalog just released, describes and illustrates a wide variety of construction projects on which these steel forms are particularly suitable, including curved walls, tapered walls, tunnels, columns, corbels and offsets as well as simple walls. The catalog pictures various sizes and styles of form panels, accessories, supplies and tools, and explains money-saving features. Economy Forms Corp., Box 128-AF, Highland Park Sta., Des Moines, Iowa.

products

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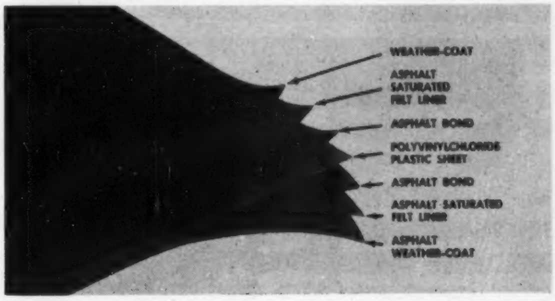
building project reports

A 24-page booklet, "Dodge Reports: How to Use Them Effectively," explains fully the purpose and use of these construction reports. Dodge Reports tell you what new construction is contemplated, being planned, ready for bidding and what contracts have been awarded, as well as who will award the contract, specify materials and equipment, and do the buying. Suggestions on effective selling are included. F. W. Dodge Corp., Construction Div., 119 West 40th St., New York, N.Y.



plastic liner

A mat-type liner which provides for the containment of water, brines, chemicals and sewage is manufactured in sheet form, and coated on the exterior with additional asphalt for maximum weather resistance. Liners are suitable for water reservoirs, chemical treatment ponds, sewage lagoons, for the general control of liquids and vapor, and for soil isolation of structures. W. R. Meadows, Inc., 26 Kimball Street, Elgin, Illinois.

redesigned power trowels

The manufacturer announces 11 completely redesigned power trowels. Improvements include a lower center of gravity for easier handling, stabilizer ring for smoother operation, air-cooled gear box for longer life, positive-action "kill" switch for greater safety and a longer handle with 25% less pull on the operator. Each model, from 30 inches to 46 inches is properly powered for peak efficiency. Whiteman Manufacturing Co., 13020 Pierce St., Pacoima, Calif.

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